Experimental Model of Knee Osteoarthritis in Rats on the Background of Intra-Articular Administration of Platelet-Enriched Autologous Plasma

Ziyadullaev A. X.
Bukhara State Medical Institute

Relevance. Deforming osteoarthritis is a heterogeneous group of joint diseases of various etiologies, but with identical biological, morphological and clinical signs and outcome associated with loss of hyaline cartilage and concomitant damage to other anatomical structures and tissues of the joint (subchondral bone, synovial membrane, ligaments, joint capsule, per articular tendons and muscles). Hyaline cartilage contains a relatively small number of cells surrounded by a large amount of intercellular matrix. Chondrocytes are involved in the regulation of synthesis and degradation of cartilage matrix components, and normally these processes are in equilibrium [1.3.5.7.9.11].

Under the influence of many factors, the balance of degradation and repair processes is disrupted, which subsequently causes the development of osteoarthritis, manifested by degenerative-dystrophic changes in the structure of hyaline cartilage and subchondral bone, inflammation in the surrounding soft tissues, violation of the physico-chemical properties of synovial fluid [2.4.6.8.10.12]. The possibility of controlling the biological potential of one's own body and using it in the treatment process seems very promising and has already been confirmed in a number of works on platelet-enriched plasma (OTP). The content of a large number of growth factors in OTP, which can be simultaneously or gradually released into the surrounding tissues, suggests the possibility of influencing the course of the inflammatory process in the joint and remodeling of hyaline cartilage [13.14.15.16.17.18.19]. Existing experimental studies on this subject remain controversial and do not yet allow us to form a holistic view of the pathomorphosis of structural changes in cartilage tissue after the use of OTP on the background of osteoarthritis [20.21.22.23].

The Purpose of The Work. To evaluate morphological changes in the structure of hyaline cartilage of the knee joint in experimental osteoarthritis after intra-articular injection of OTP.

Cartilage tissue with subchondral bone was fixed in a 10% solution of neutral buffered formalin (pH 7.4). Acid-free decalcification was performed in a standard concentration sodium ethylenediaminetetraacetate solution. After complete removal of the mineral component from the bone tissue, standard histological wiring was performed for alcohols of increasing concentrations and the preparations were enclosed in paraffin, after which sections were made with a thickness of 6 to 8 microns, stained with hematoxylin and eosin according to Mallory [24.26.28.30.32.34]. Photoprotoculation of microscopic changes was performed using a complex including an Axio Scope microscope (Carl Zeiss, Germany) and a Power Shot digital camera (Canon, Japan). Morphometric analysis was carried out using the computer program "Video TestMorfo-4" (Russia). To assess morphological parameters, the thickness of articular cartilage (L, microns) and the volume fraction of chondrocytes relative to the matrix (OD, %) were determined [25.27.29.31]. The analysis of parameters with a normal distribution of values was carried out using the Student's criterion, the analysis of nonparametric quantitative features using the Mann-Whitney criterion. To compare qualitative features, the criteria of χ 2 and Fischer were used. Differences were considered significant if the probability of error did not exceed $p < 0.05$.

Results. The study showed that in the control group of animals articular 293 hyaline cartilage had a thickness (330 ± 17.3) microns and a characteristic histological structure. The surface chondrocytes

were characterized by a flattened shape and were located singly in the cartilaginous matrix. The chondrocytes of the transitional and basal zones had a rounded shape and were located in isogenic groups in rows oriented perpendicular to the articular surface. The volume fraction of chondrocytes was (13.7 ± 1.1)% (Table 2). Morphological signs of degenerative-dystrophic processes were not visualized. The immunochemical reaction according to Mallory revealed a uniform arrangement of collagen fibers, the absence of foci of ossification. After modeling osteoarthritis, the thickness of articular cartilage decreased to (121 ± 20.4) microns ($p < 0.05$) and the volume fraction of chondrocytes decreased to (1.2 ± 0.6)% ($p < 0.05$). In all zones, multiple "empty lacunae" and chondrocytes with karyopycnosis were noted, extensive areas of destruction of the articular surface with the growth of connective tissue, in the thickness of which granulomatous inflammation with pronounced histiomacrophagal infiltration and giant multinucleated cells of the type of foreign bodies, fullness of blood vessels and uneven swelling of the intercellular substance were determined [33.35.37.39].

Histochemical examination of articular cartilage revealed uneven staining of collagen fibers with a pronounced violation of the tinctorial properties of the matrix of cartilage tissue. In the areas of sclerosis, collagen fibers were colored most intensively. After the introduction of OTP against the background of experimental osteoarthritis, morphometrically an increase in the thickness of articular cartilage to (275 ± 18.9) microns ($p < 0.05$) and the volume fraction of chondrocytes to (18.4 ± 2.0)% ($p < 0.05$) was found. There were three zones separated from each other with degenerative changes typical of osteoatrosis, but less pronounced. In the surface area, the contours of the articular surface looked smooth. Despite the presence of "empty" lacunae and chondrocytes with signs of decay and the formation of apoptotic bodies, an increase in the number of both separately located chondrocytes and their isogenic groups in all zones was determined. Focal ossification of the intercellular substance took place in the intermediate zone, which was especially noticeable with Mallory staining. The uniformity of the distribution of collagen fibers and the tinctorial properties of the cartilage matrix were preserved in all zones. To date, in clinical practice, various attempts are being made to influence the course of the inflammatory process in the joint and degenerative-dystrophic changes in hyaline cartilage. The role of platelets in the pathogenesis of osteoarthritis, apparently, is more multifaceted than we imagine today. Platelets contain a large amount of a control group; b experimental group 1; The experimental group includes 2 rapidly released substances that participate in the first phase of inflammation, affecting the course of the inflammatory process in the joint, modulating its duration and activity. Blood plates activate the processes of migration and activation of leukocytes, as well as repair in tissues, which determines the prospect of widespread use of medicinal forms containing them in clinical practice. A high level of beta-thromboglobulin, platelet factor 4 in OTP stimulates the inflammatory response by activating the migration of neutrophils [35.36.38.39].

The work is devoted to the study of the longitudinal arch of the foot in children using an original software and hardware complex. In total, there were people under observation, including 134 children of the first childhood, 302 of the second childhood, 222 people of adolescence, as well as 631 young people. In each age group, the body type was studied in girls and boys. As a result of the study, it was revealed that during the first childhood, gender differences in the longitudinal arch of the foot are not detected, at the same time somatotypic differences are detected.

Conclusion. During the second childhood, gender-specific and somatotypic significant differences in the longitudinal arch of the foot are revealed compared to the period of the first childhood. In adolescence, boys have higher K coefficient indicators, indicating a lower location of the longitudinal arch of the foot compared to girls. The adolescent period is characterized by the ontogenetic completion of the formation of the longitudinal arch of the foot, its most pronounced

somatotypic and gender differences.

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